

## Thermal Management System for Long-Lived Venus Landers, Phase II

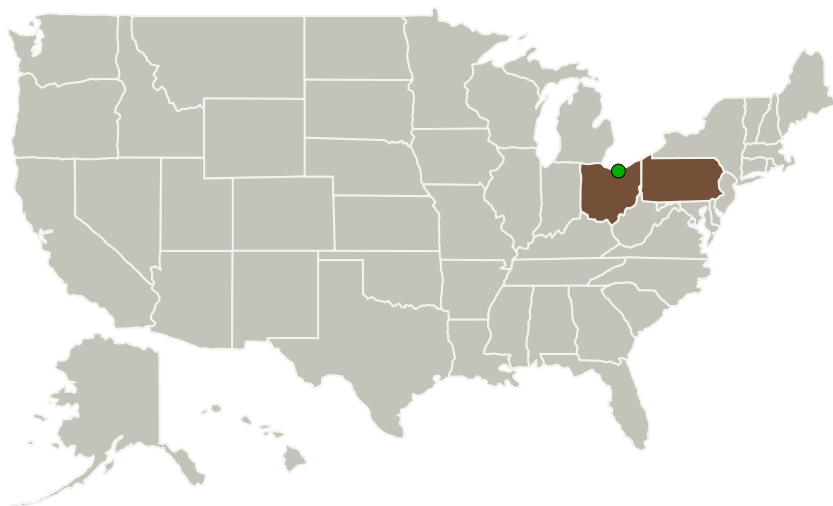
Completed Technology Project (2011 - 2013)



## Project Introduction

The overall program objective is to develop a high-temperature passive thermal management system for the Radioisotope Power Conversion system that energizes the refrigeration system applicable to Venus missions. The innovation consists of a high temperature alkali metal variable conductance heat pipe (VCHP) integrated with a two-phase heat collection / transport package from the General Purpose Heat Source (GPHS) stack to the Stirling convertor heater head. The thermal management system collects the heat from the GPHS modules, and delivers heat as required to the Stirling system. Any excess heat is removed by the VCHP. Excess heat must be removed when the Stirling system is shut down, or in the early stages of a mission powered by a short-life radioisotope. In Phase I, it was demonstrated experimentally and theoretically that the VCHP allows the Stirling convertor to: stop during transit to Venus, pre-cool the system before re-entry, work on Venus and execute brief stoppages on Venus. The reservoir is exposed to the environment temperature during the mission and this is a key for the HTMS to work passively. The other component of the system, the two-phase heat transport package (HTP), minimizes the temperature drop between the multi-GPHS stack and the heater head. In Phase II, a full scale HTMS will be designed and a representative multi-segment of the full scale HTMS will be build and tested in relevant environment. This multi-segment contains two or three parallel/redundant heat paths from the simulated GPHS stack to the heater head simulator, in addition to the backup cooling system (VCHP). The full-scale multi-segment HTMS will be integrated and tested with the corresponding full scale multi-segment of the Intermediate Temperature Thermal Management System (ITTMS) of the Venus Lander.

## Primary U.S. Work Locations and Key Partners



Thermal Management System  
for Long-Lived Venus Landers,  
Phase II

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Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Pennsylvania

## Project Transitions

▶ **June 2011:** Project Start

✓ **May 2013:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140571>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

Advanced Cooling Technologies, Inc.

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

Carlos Torrez

## Principal Investigator:

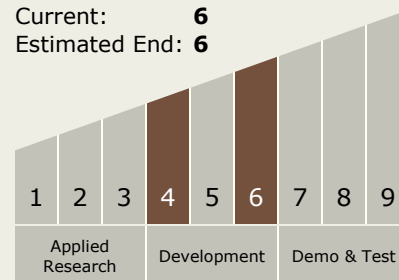
Calin Tarau

## Technology Maturity (TRL)

Start: 4

Current: 6

Estimated End: 6



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## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.2 Thermal Control Components and Systems
    - └ TX14.2.2 Heat Transport

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System